Terrestrial Carbon Sequestration

Forest Carbon Projects

Katie Goslee
Program Associate
Winrock International
kgoslee@winrock.org

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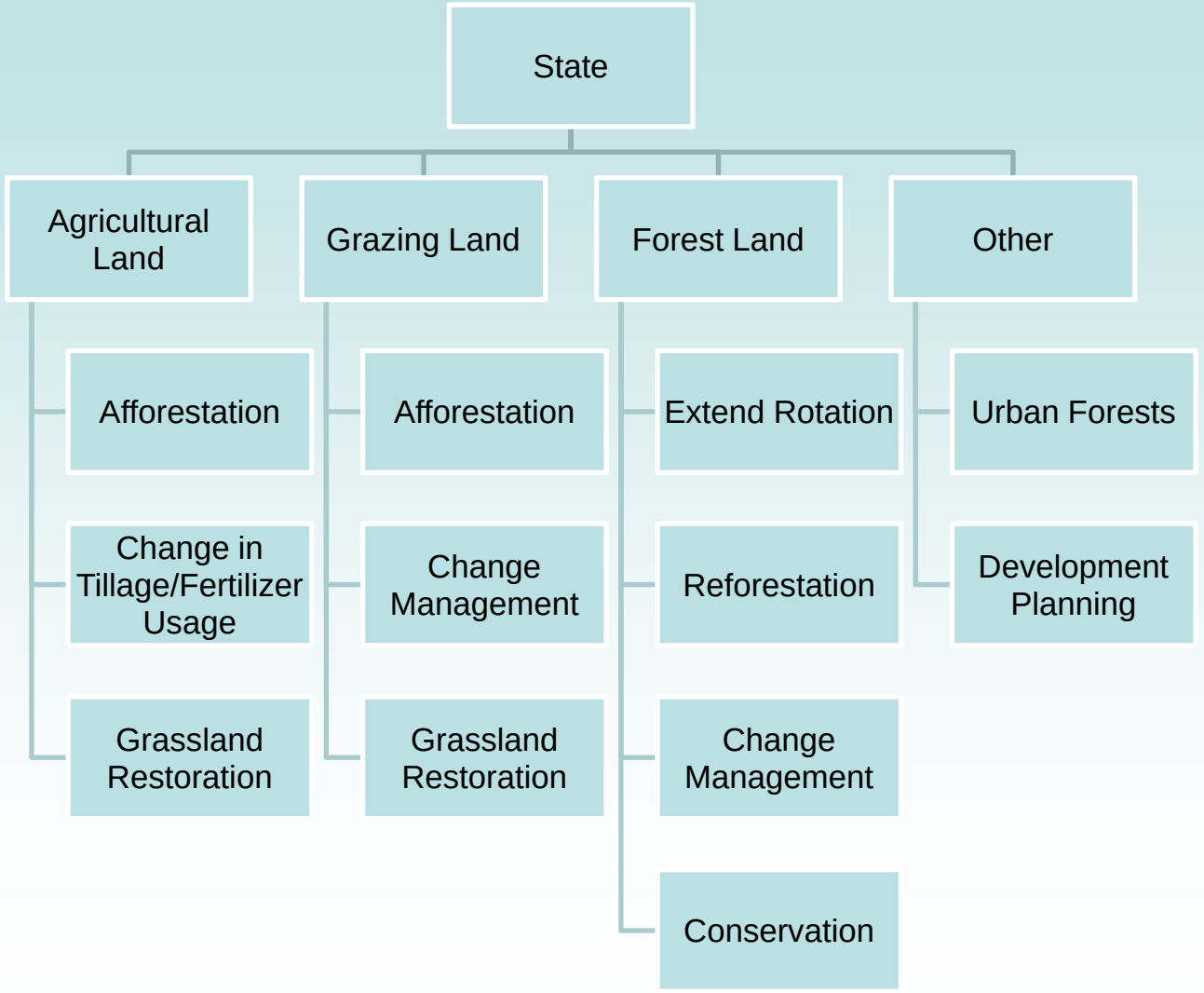
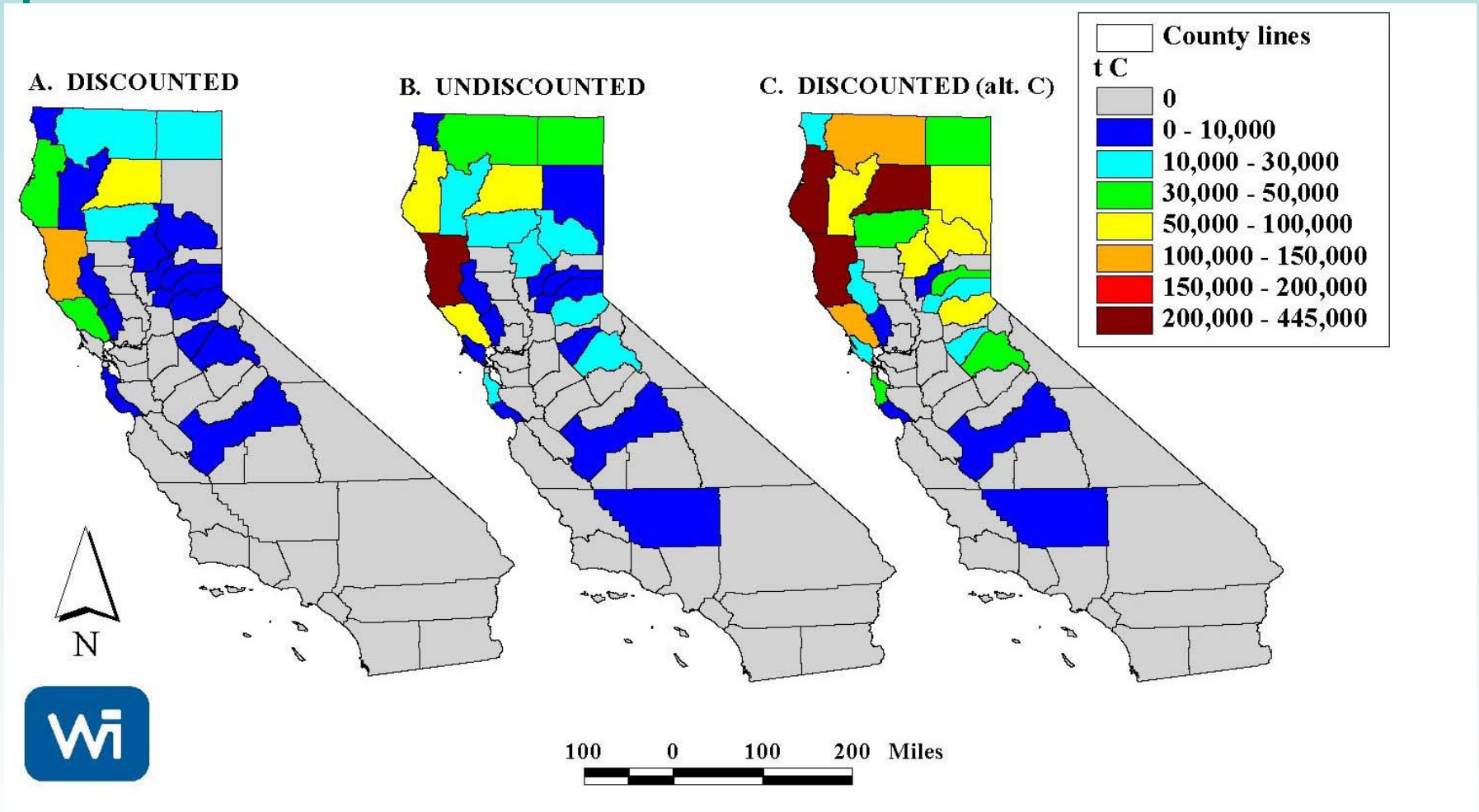
Terrestrial Sequestration Options

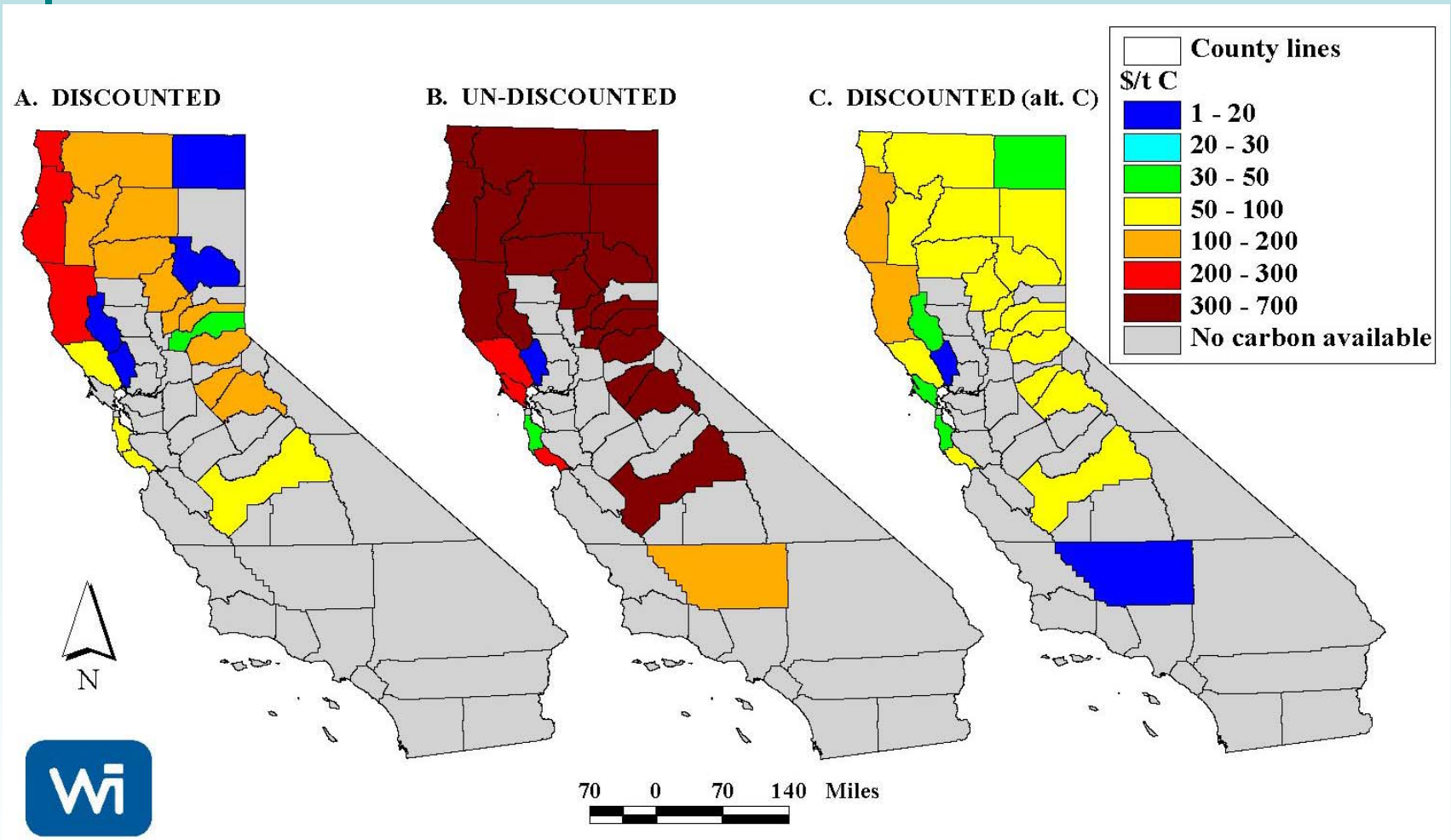


Change Forest Management

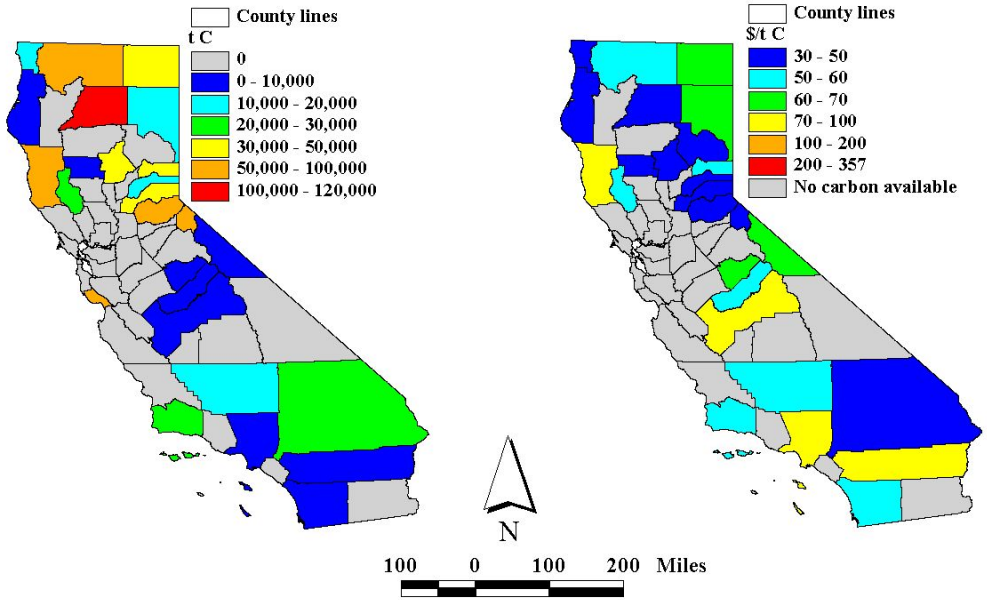
Source: Tim Pearson, Winrock International

- Rotation length
- Extend riparian zones
- Slash left in forest
- Volume logged
- Assess wood products
  - Quantity
  - Type
  - Turnover

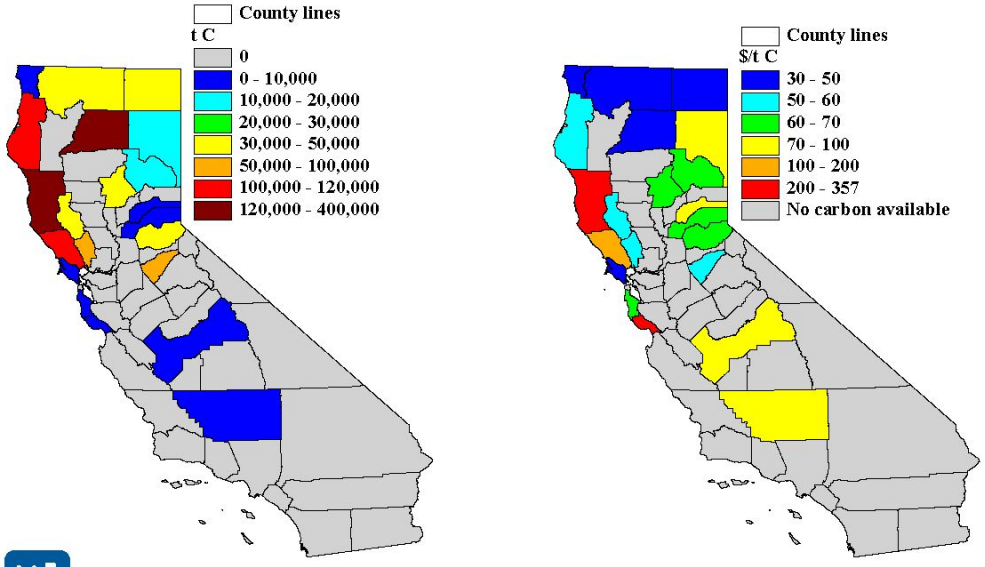

A. DISCOUNTED
B. UNDISCOUNTED
C. DISCOUNTED (alt. C)
County lines
t C
0
0 - 10,000
10,000 - 30,000
30,000 - 50,000
50,000 - 100,000
100,000 - 150,000
150,000 - 200,000
200,000 - 445,000
N
100 0 100 200 Miles


A. DISCOUNTED
B. UN-DISCOUNTED
C. DISCOUNTED (alt. C)
County lines
$/t C
1 - 20
20 - 30
30 - 50
50 - 100
100 - 200
200 - 300
300 - 700
No carbon available
N
70 0 70 140 Miles

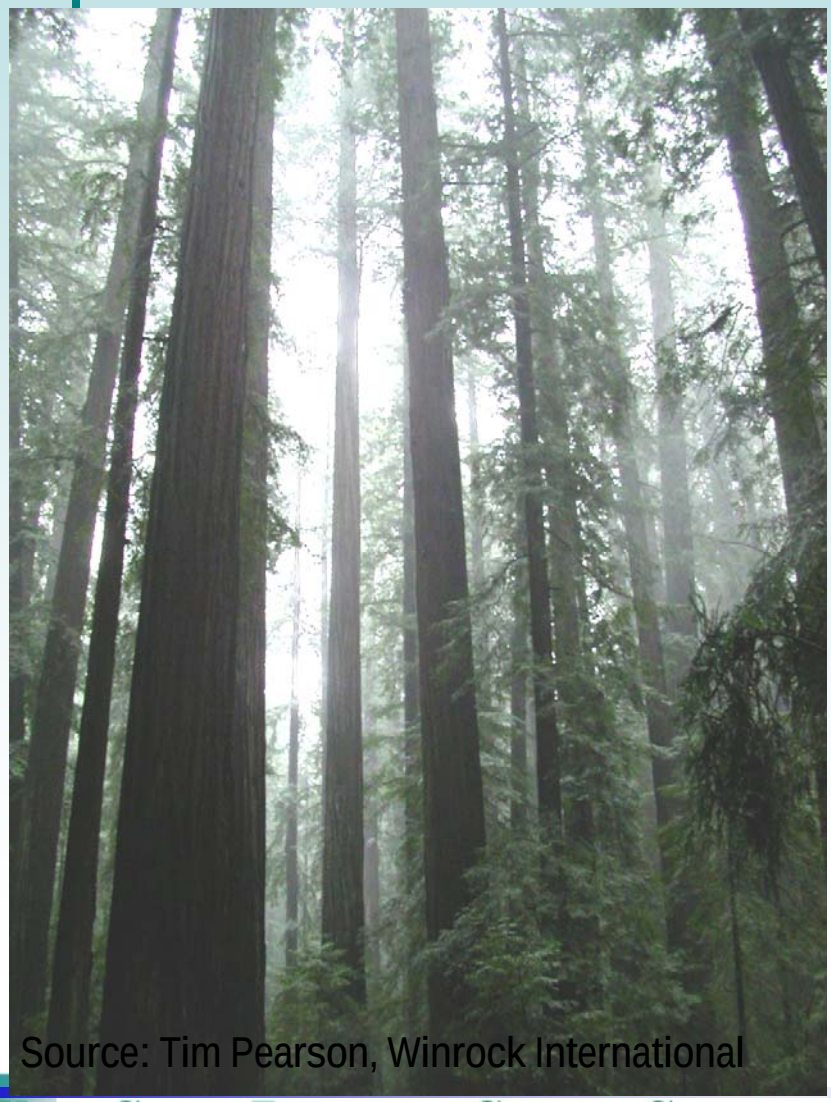
A. PUBLIC LANDS



B. PRIVATE LANDS



Conserve Forests



Source: Tim Pearson, Winrock International

- Stop forest conversion to non-forest
- Sierra Mixed Conifer (150 year old forest)
  - 376 tC/ha
- Redwood (150 year old forest)
  - 478 tC/ha

Afforestation/ Reforestation

- Convert agricultural or grazing land back to forest
  - Return to native forest
  - Convert to forest land for timber production

Source: Tim Pearson, Winrock International

- Rate of Carbon Sequestration for Douglas Fir

  5 tC/ha yr x 20 yrs

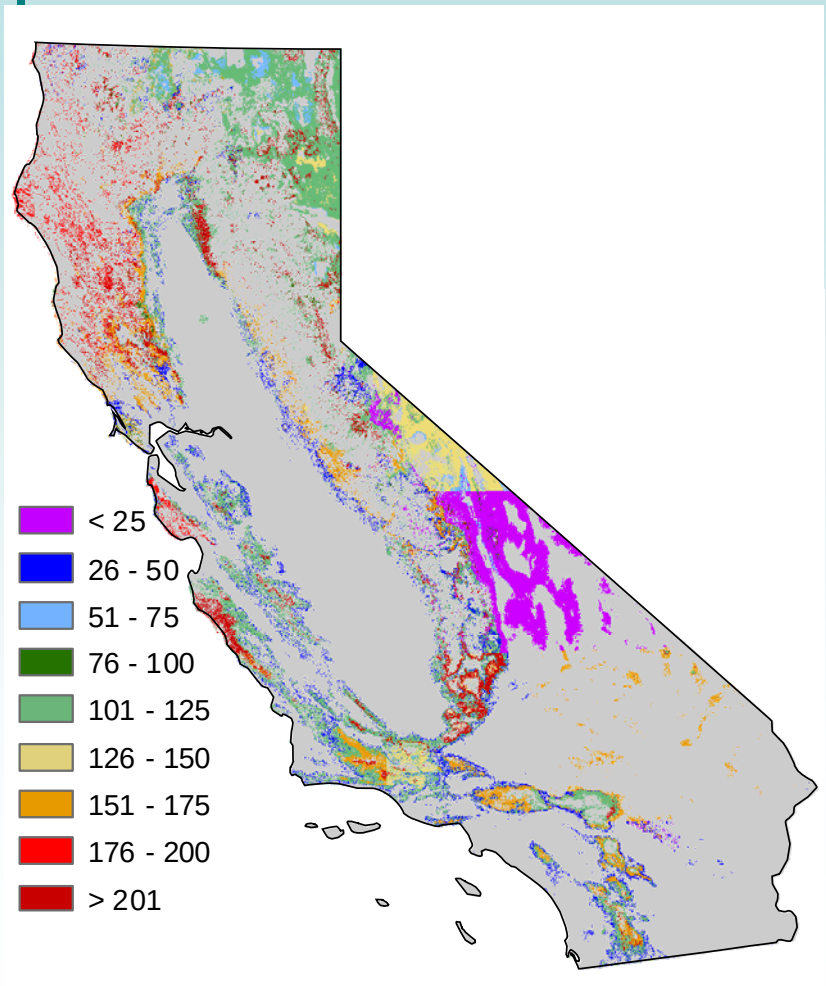
  =100 tC/ha

  = 148 tCO_2/ac

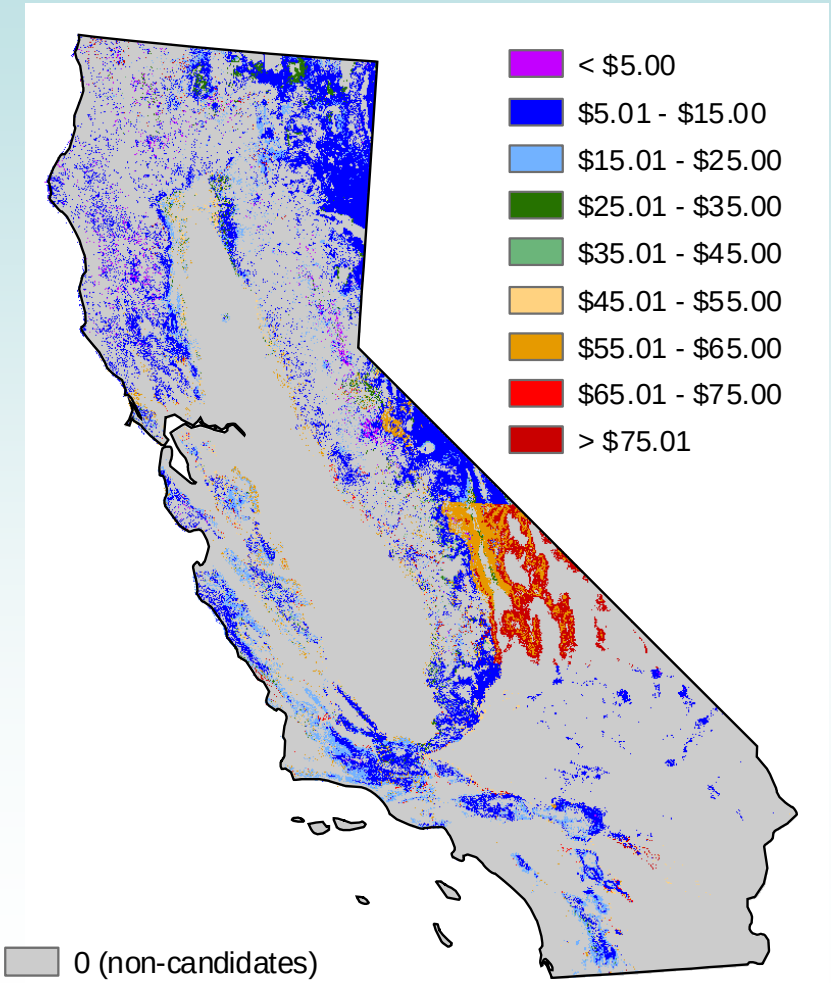
Summary of Available Carbon

Activity	Quantity of C—MMT CO_2			Area available—million acres		
	20 years	40 years	80 years	20 years	40 years	80 years
Forest management						
Lengthen rotation						
≤$13.6 (discounted C)	3.47	--	--	0.31	--	--
≤$13.6 (undiscounted C)	2.16	--	--	0.30	--	--
Increase riparian buffer-width						
≤$13.6	3.91 (permanent)			0.044		
Grazing lands						
Afforestation						
≤$13.6	887	3,256	5,639	12.03	17.79	20.76
≤$5.5	345	3,017	5,504	2.72	14.83	19.03
≤$2.7	33	1,610	4,569	0.20	5.68	13.34

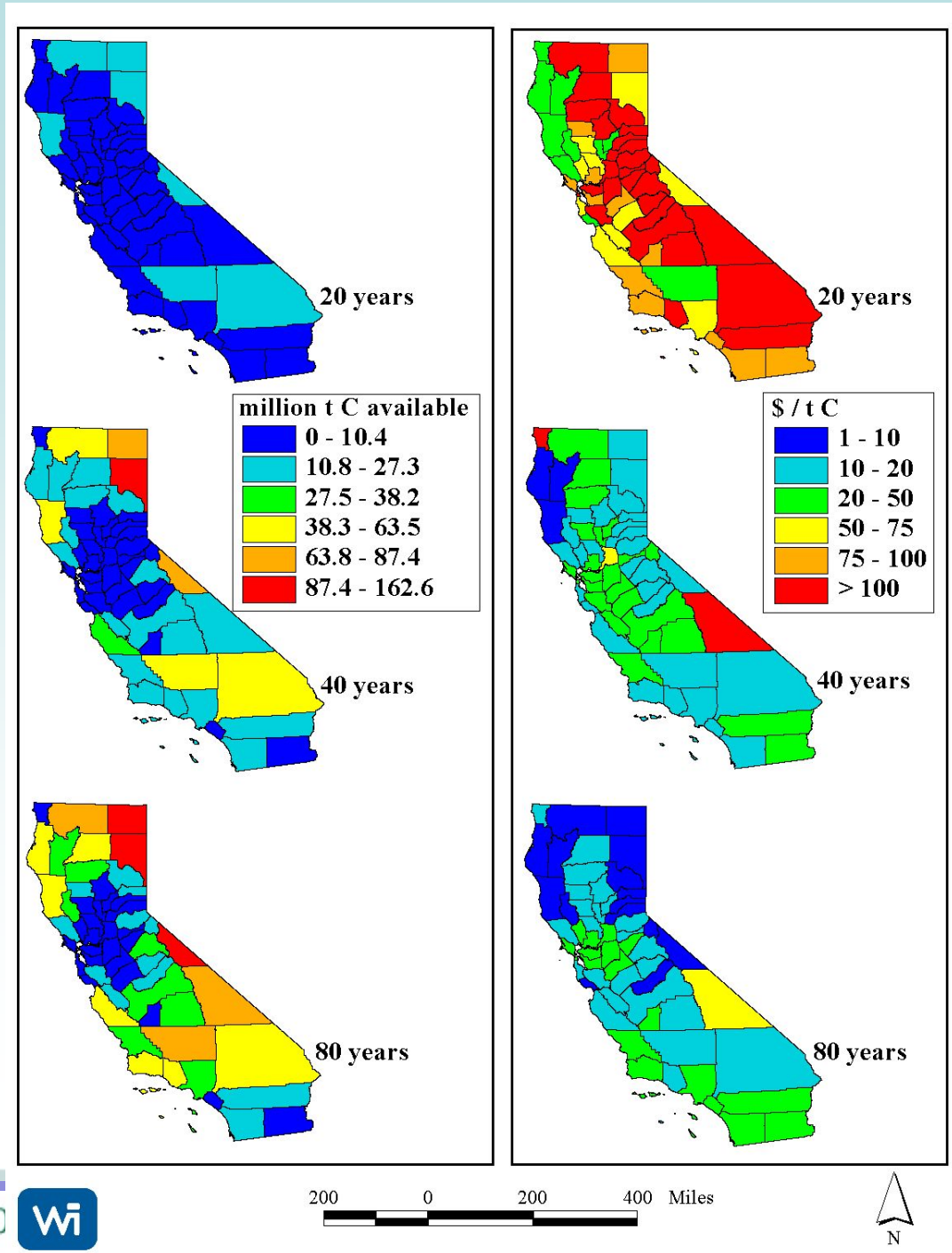
Afforestation – CA statewide analysis
Potential sequestration and cost (40 Years)

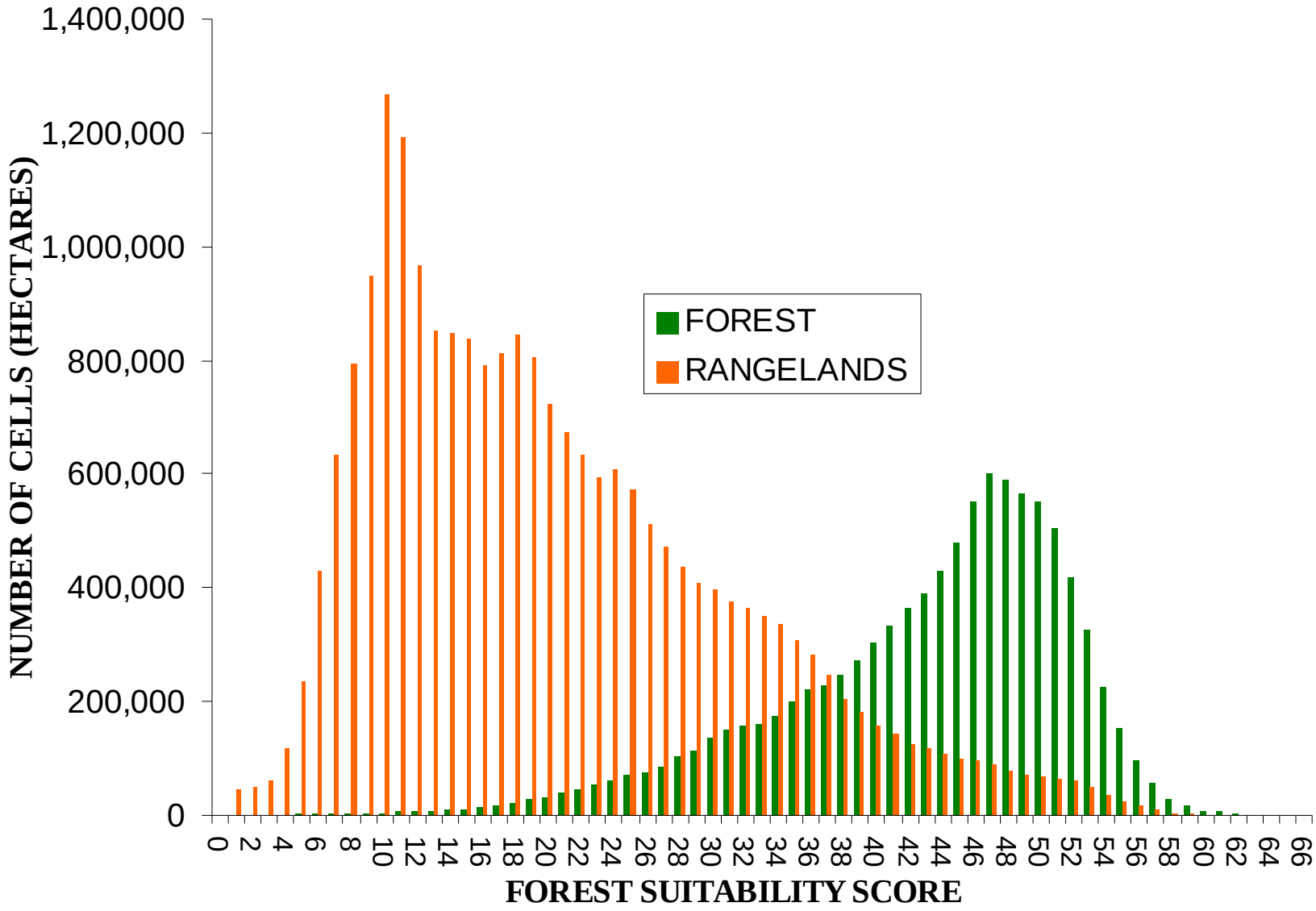


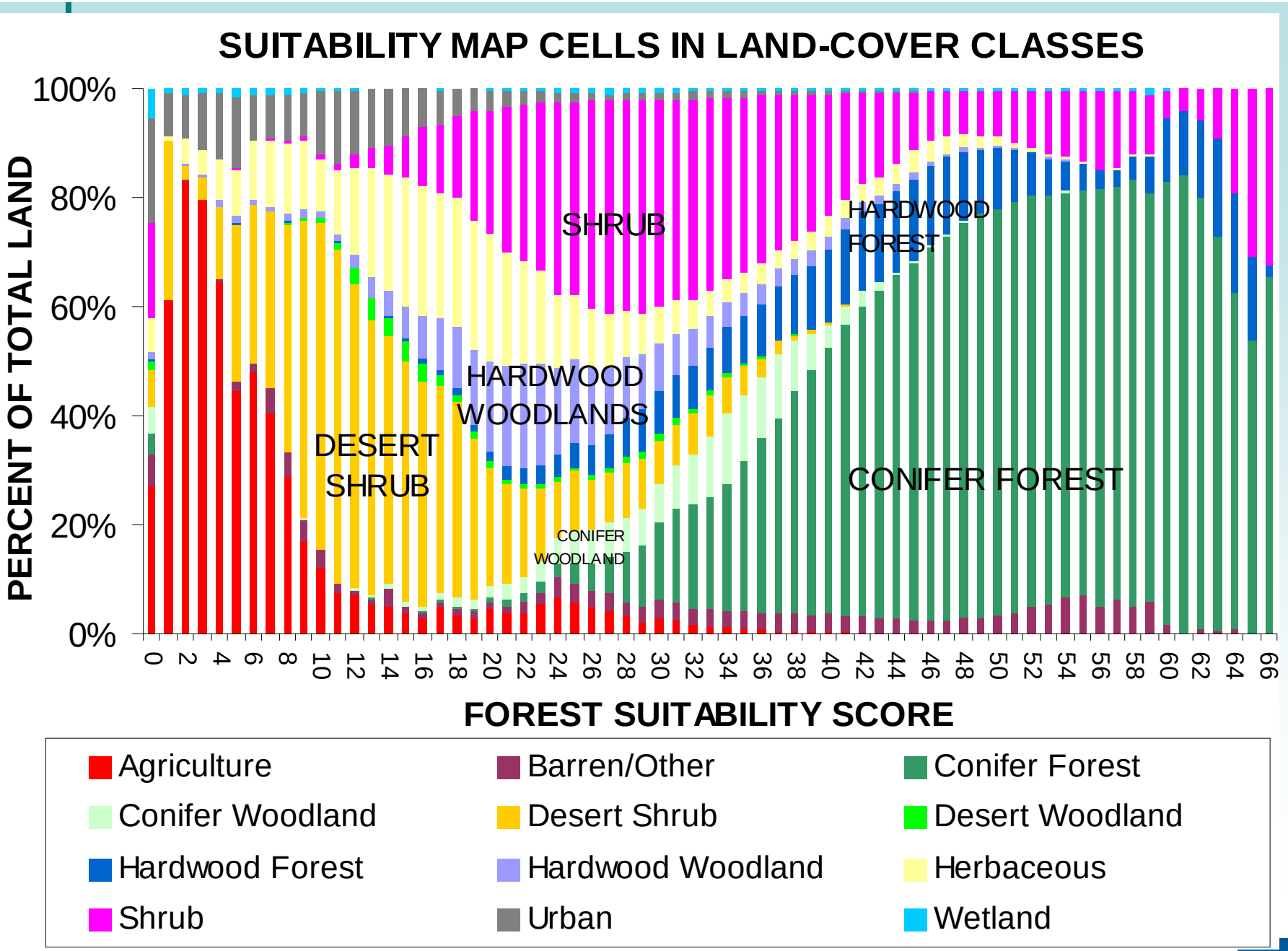
Potential t C/ ha

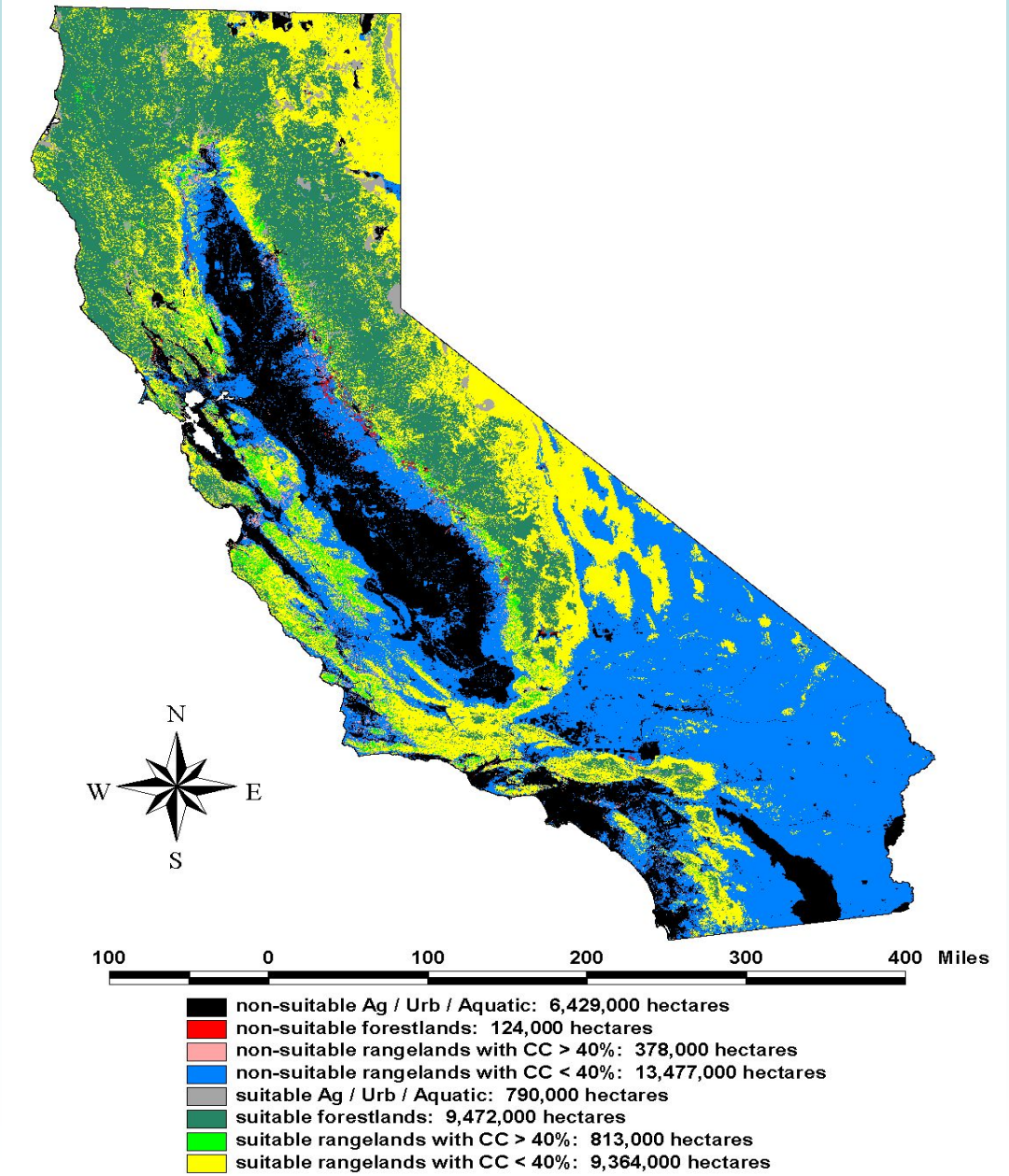


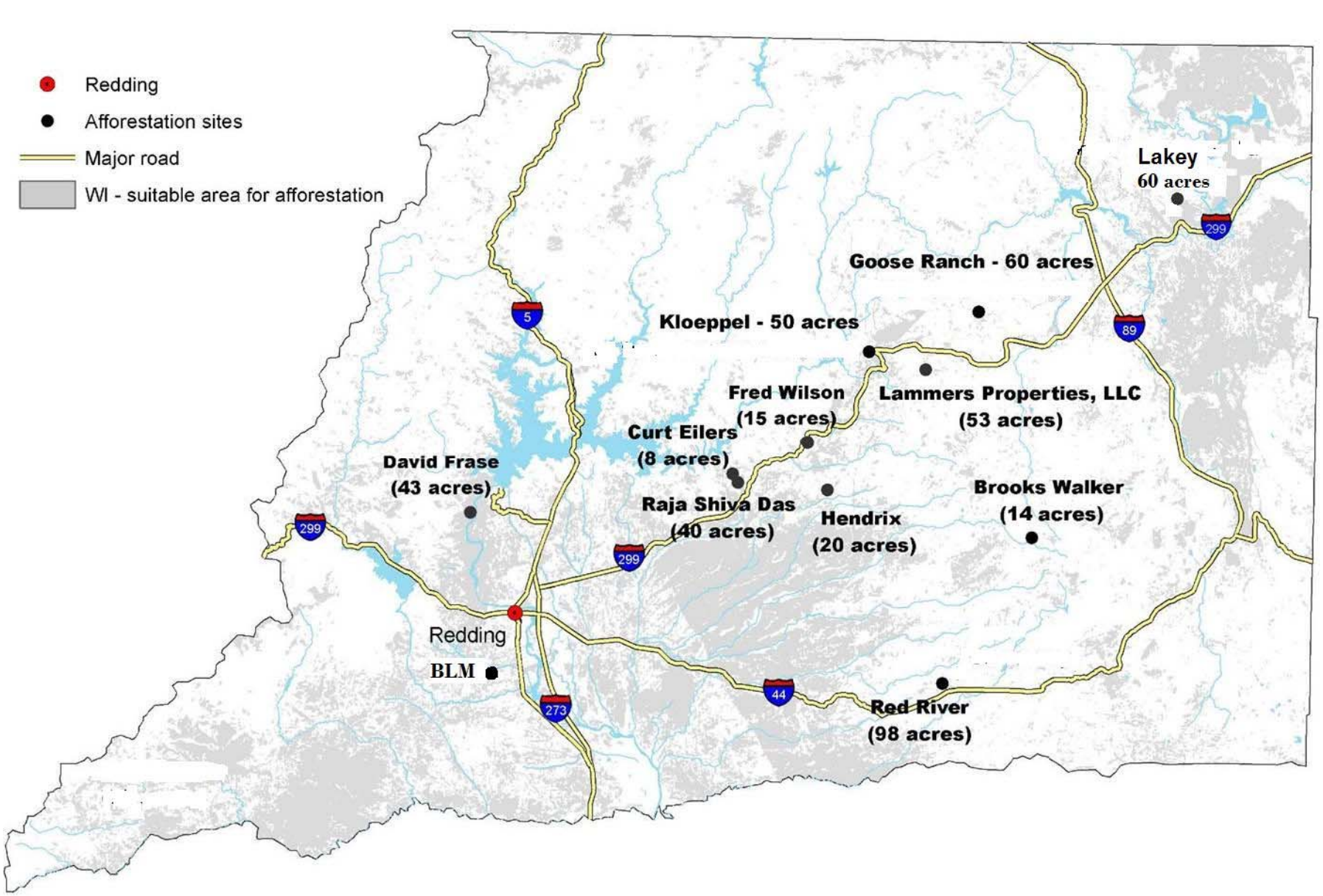
$ / t C

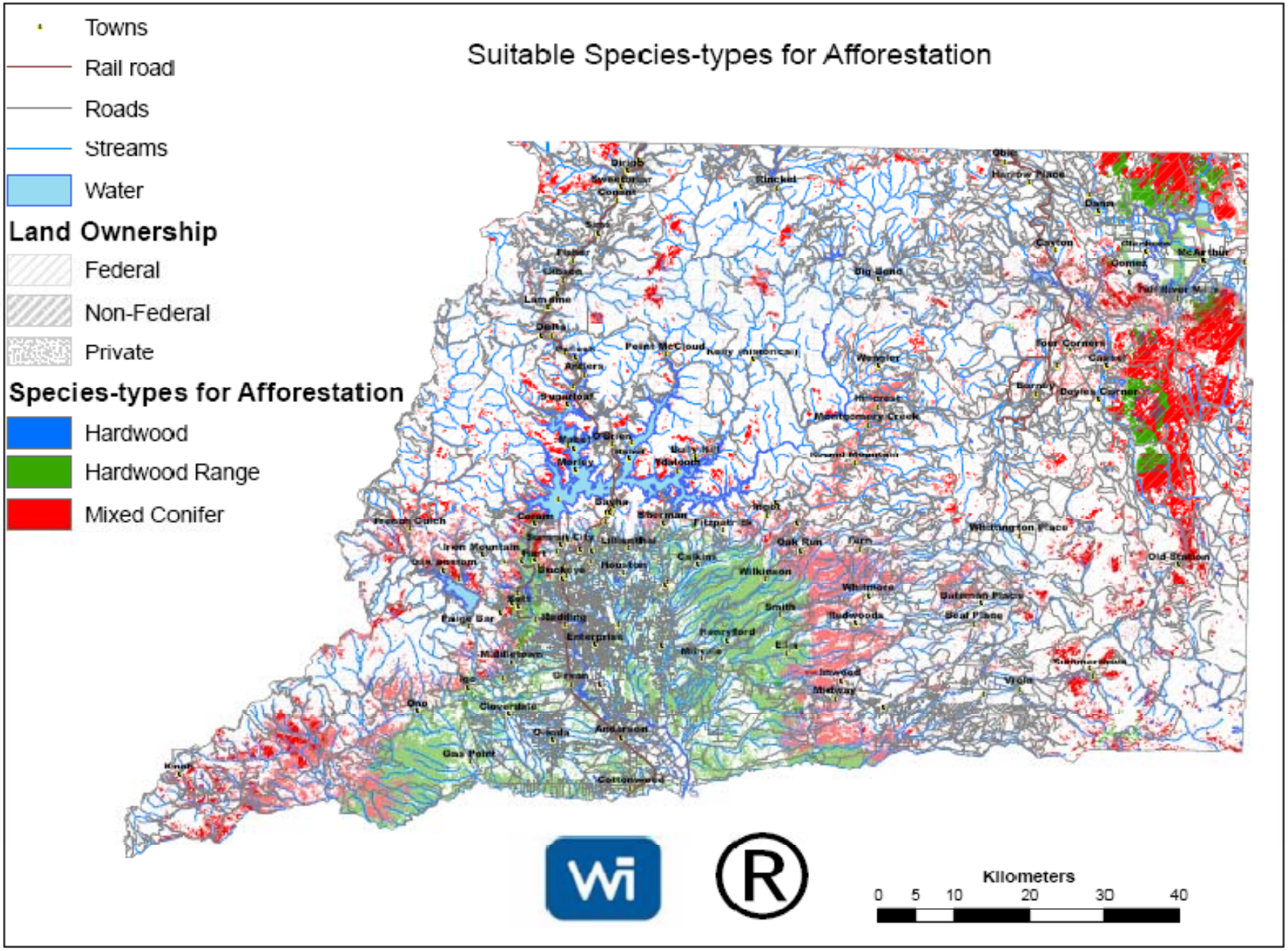

20 years
40 years
80 years
million t C available
0 - 10.4
10.8 - 27.3
27.5 - 38.2
38.3 - 63.5
63.8 - 87.4
87.4 - 162.6
20 years
40 years
80 years
$ / t C
1 - 10
10 - 20
20 - 50
50 - 75
75 - 100
> 100
200 0 200 400 Miles
N


1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
NUMBER OF CELLS (HECTARES)
FOREST
RANGELANDS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
FOREST SUITABILITY SCORE


SUITABILITY MAP CELLS IN LAND-COVER CLASSES
PERCENT OF TOTAL LAND
100%
80%
60%
40%
20%
0%
SHRUB
HARDWOOD FOREST
HARDWOOD WOODLANDS
DESERT SHRUB
CONIFER FOREST
CONIFER WOODLAND
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66
FOREST SUITABILITY SCORE
Agriculture
Barren/Other
Conifer Forest
Conifer Woodland
Desert Shrub
Desert Woodland
Hardwood Forest
Hardwood Woodland
Herbaceous
Shrub
Urban
Wetland


N
W
E
S
100
0
100
200
300
400 Miles
non-suitable Ag / Urb / Aquatic: 6,429,000 hectares
non-suitable forestlands: 124,000 hectares
non-suitable rangelands with CC > 40%: 378,000 hectares
non-suitable rangelands with CC < 40%: 13,477,000 hectares
suitable Ag / Urb / Aquatic: 790,000 hectares
suitable forestlands: 9,472,000 hectares
suitable rangelands with CC > 40%: 813,000 hectares
suitable rangelands with CC < 40%: 9,364,000 hectares


Redding
Afforestation sites
Major road
WI - suitable area for afforestation
Lakey
60 acres
Goose Ranch - 60 acres
Kloeppel - 50 acres
Fred Wilson
(15 acres)
Lammers Properties, LLC
(53 acres)
Curt Eilers
(8 acres)
David Frase
(43 acres)
Raja Shiva Das
(40 acres)
Hendrix
(20 acres)
Brooks Walker
(14 acres)
Redding
BLM
Red River
(98 acres)
5
89
299
299
299
44
273


Towns
Rail road
Roads
Streams
Water
Land Ownership
Federal
Non-Federal
Private
Species-types for Afforestation
Hardwood
Hardwood Range
Mixed Conifer
Suitable Species-types for Afforestation
Kilometers
0 5 10 20 30 40

Shasta afforestation preliminary baseline

Project	Baseline vegetation	Baseline C prior to site prep		
		Mean (tCO2/ac)	95% CI (tCO2/ac)	# plots
Red River Forests Partnership	Greenleaf manzanita	11.4	5.2	8
Hendrix-Philips	Whiteleaf manzanita	41.3	15.9	10
Goose Valley Ranch	Whitethorn	84.2	36.8	10
Sivadas	Old whiteleaf manzanita	53.6	54.9	11
Wilson	Whiteleaf manzanita	26.6	8.6	7
Lammers	Greenleaf, deer brush, whitethorn	17.9	8.3	7

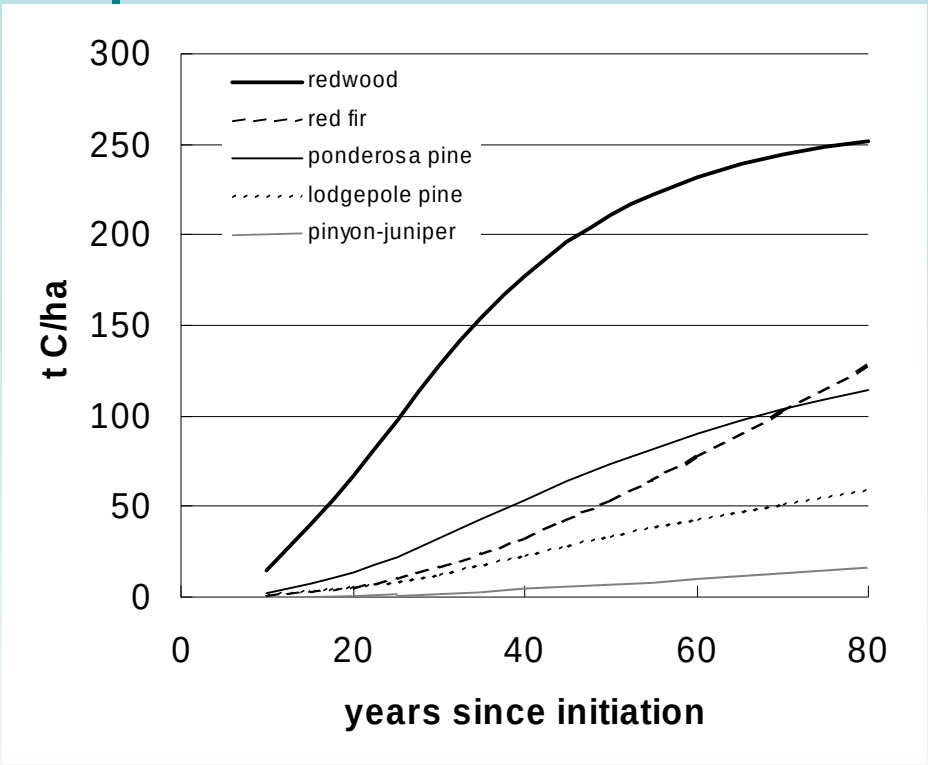
Shasta Afforestation Projects

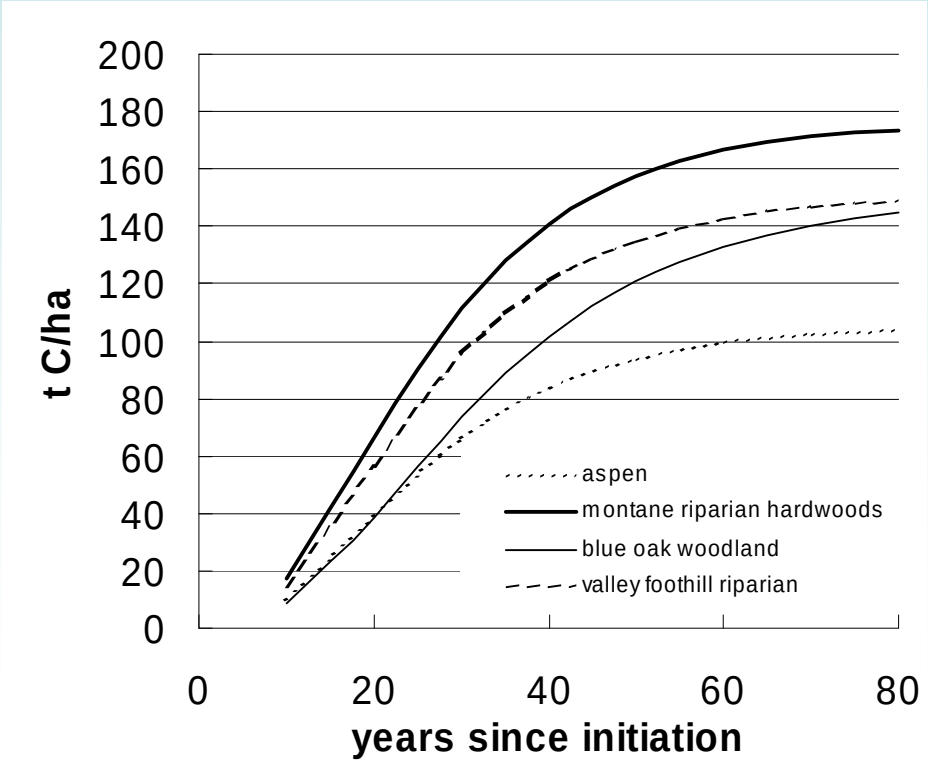
Project	Acres	Description	Status
Red River Forest Partnership	**98**	**Ponderosa pine afforestation, *brush removal for bioenergy***	**Site prep done, planting done**
Goose Valley	**60**	**Ponderosa, Doug fir, cedar, past fire site**	**Site prep done, planting done**
Frase	**43**	**Ponderosa pine afforestation, affected by copper smelting in 1910**	**Site prep done, planting in 2009**
Eilers	**8**	**Oak pine afforestation**	**Collecting acorn crop, planting in 2009**
Lakey	**60**	**Ponderosa pine afforestation, recent fire (2007)**	**Site prep done, planting in 2009**
BLM	**10**	**Oak woodlands**	**Planting done in 2009**

Shasta Afforestation Projects

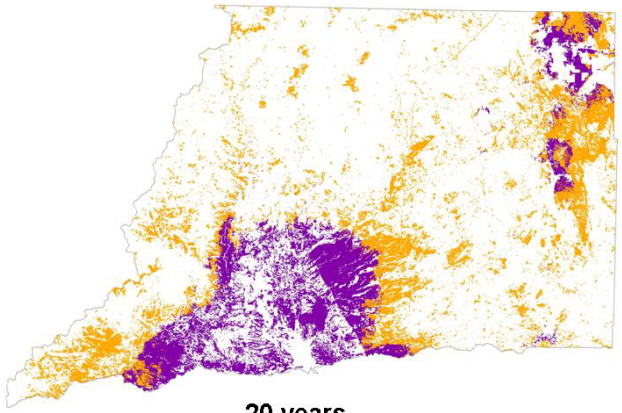
Project	Acres	Description	Status
Red River Forest Partnership	98	Ponderosa pine afforestation, *brush removal for bioenergy*	Site prep done, planting done
Brooks Walker	14	Mixed conifer afforestation	Site prep done, planting done
Hendrix Phillips	20	Ponderosa pine afforestation, easement on property	Site prep done, planting done
Goose Valley	60	Mixed conifer afforestation, past fire site	Site prep done, planting done
Lammers	53	Mixed conifer afforestation, past fire site (1992)	Site prep fall 2008, planting in 2009
Frase	43	Ponderosa pine afforestation, affected by copper smelting in 1910	Site prep done, planting in 2009
Kloeppel	51	Ponderosa pine afforestation, past fire site (1992)	Site prep done, planting in 2009
Sivadas	38	Ponderosa pine afforestation	Site prep done, planting in 2009
Eilers	8	Oak pine afforestation	Collecting acorn crop, planting in 2009
Wilson	15	Ponderosa pine afforestation	Site prep done, planting in 2009
Lakey	60	Ponderosa pine afforestation, recent fire (2007)	Site prep done, planting in 2009
BLM	10	Oak woodlands	Planting done in 2009

Growth Curves

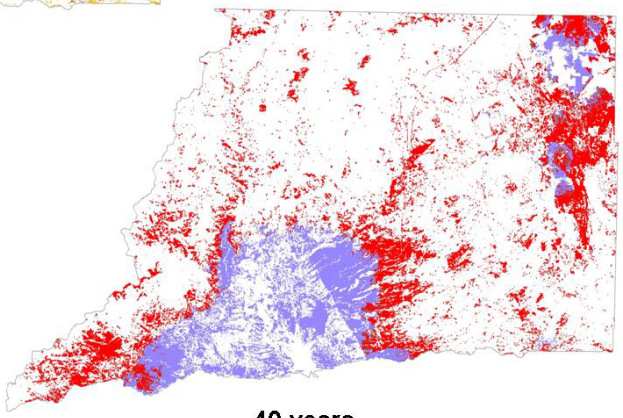




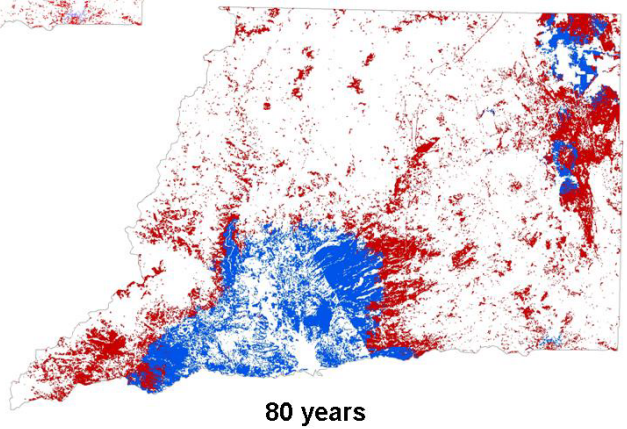
Rates for Carbon accumulation



20 years



40 years



80 years

tC/ ha

- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 150
- 151 - 200
- > 200

Projections – 300 trees/acre

	tons CO_2/ac	
Year	Pine	Doug fir
2008	24.6	21.6
2018	23.7	22.4
2028	35.7	41.5
2038	73.2	98.0
2048	118.5	166.4
2058	178.9	242.8
2068	235.6	300.5
2078	300.6	344.2
2088	338.5	378.1

Costs for Carbon Management Projects

- Establishment costs
  - Site preparation
  - Buying and planting seedlings
  - Easements
  - Validation
- Maintenance costs
- Measurement costs
  - Registry
  - Variability
  - Project area

Costs for Carbon Management Projects

- Opportunity costs
  - Existing income from:
    - Farming
    - Grazing
    - Wood products
- Carbon alone rarely covers all costs

Costs

	10 year			40 year		
	Opportunity	Conversion	M+M	Opportunity	Conversion	M+M
Connecticut	72%	26%	1%	86%	13%	1%
Delaware	68%	31%	1%	83%	16%	1%
Maine	71%	28%	1%	85%	14%	1%
Maryland	47%	52%	1%	68%	31%	0%
Massachusetts	74%	25%	1%	87%	12%	0%
New Hampshire	72%	27%	1%	86%	13%	1%
New Jersey	40%	59%	1%	61%	38%	1%
New York	65%	64%	2%	82%	43%	1%
Pennsylvania	47%	52%	1%	68%	31%	0%
Rhode Island	64%	35%	1%	81%	18%	1%
Vermont	71%	28%	1%	85%	14%	1%
Mean	63%	39%	1%	79%	22%	1%

Policy issues

- Regulation of offsets, rather than of forest sector
- Ensuring additionality is critical
- Regulatory identification of forestry practices is inappropriate
- Co-benefits are high in forest projects

Contact info

Katie Goslee
Winrock International
(510) 845-0968
kgoslee@winrock.org